In certain other preferred embodiments, the metal oxide materials may include those in which

M^1O_x is Ce_aO_x, CoO_x, CuO_x, FeO_x, GaO_x, NbO_x, NiO_x, PrO_x, RuO_x, SnO_x, Ta_aO_x, TiO_x, TmO_x, WO_x, YbO_x, ZnO_x, ZrO_x , SnO_x with Ag additive, ZnO_x with Ag additive, TiO_x with Pt additive, ZnO_x with frit additive, NiO_x with frit additive, SnO_x with frit additive, or WO_x with frit additive; and/or

$M^1{}_aM^2{}_bO_x$ is $Al_aCr_bO_x$, $Al_aFe_bO_x$, $Al_aMg_bO_x$, $Al_aNi_bO_x$, $Al_aTi_bO_x$, $Al_aV_bO_x$, $Ba_aCu_bO_x$, $Ba_aSn_bO_x$, $Ba_aZn_bO_x$, $Bi_aRu_bO_x$, $Bi_aSn_bO_x$, $Bi_aZn_bO_x$, $Ca_aSn_bO_x$, $Ca_aZn_bO_x$, $Cd_aSn_bO_x$, $Cd_aZn_bO_x$, $Ce_aFe_bO_x$, $Ce_aNb_bO_x$, $Ce_aTi_bO_x$, $Ce_aV_bO_x$, $Co_aCu_bO_x$, $Co_aGe_bO_x$, $Co_aLa_bO_x$, $Co_aMg_bO_x$, $Co_aNb_bO_x$, $Co_aPb_bO_x$, $Co_aSn_bO_x$, $Co_aV_bO_x$, $Co_aW_bO_x$, $Co_aZn_bO_x$, $Cr_aCu_bO_x$, $Cr_aLa_bO_x$, $Cr_aMn_bO_x$, $Cr_aNi_bO_x$, $Cr_aSi_bO_x$, $Cr_aTi_bO_x$, $Cr_aY_bO_x$, $Cr_aZn_bO_x$, $Cu_aFe_bO_x$, $Cu_aGa_bO_x$, $Cu_aLa_bO_x$, $Cu_aNa_bO_x$, $Cu_aNi_bO_x$, $Cu_aPb_bO_x$, $Cu_aSn_bO_x$, $Cu_aSr_bO_x$, $Cu_aTi_bO_x$, $Cu_aZn_bO_x$, $Cu_aZr_bO_x$, $Fe_aGa_bO_x$, $Fe_aLa_bO_x$, $Fe_aMo_bO_x$, $Fe_aNb_bO_x$, $Fe_aNi_bO_x$, $Fe_aSn_bO_x$, $Fe_aTi_bO_x$, $Fe_aW_bO_x$, $Fe_aZn_bO_x$, $Fe_aZr_bO_x$, $Ga_aLa_bO_x$, $Ga_aSn_bO_x$, $Ge_aNb_bO_x$, $Ge_aTi_bO_x$, $In_aSn_bO_x$, $K_aNb_bO_x$, $Mn_aNb_bO_x$, $Mn_aSn_bO_x$, $Mn_aTi_bO_x$, $Mn_aY_bO_x$, $Mn_aZn_bO_x$, $Mo_aPb_bO_x$, $Mo_aRb_bO_x$, $Mo_aSn_bO_x$, $Mo_aTi_bO_x$, $Mo_aZn_bO_x$, $Nb_aNi_bO_x$, $Nb_aNi_bO_x$, $Nb_aSr_bO_x$, $Nb_aTi_bO_x$, $Nb_aW_bO_x$, $Nb_aZr_bO_x$, $Ni_aSi_bO_x$, $Ni_aSn_bO_x$, $Ni_aY_bO_x$, $Ni_aZn_bO_x$, $Ni_aZr_bO_x$, $Pb_aSn_bO_x$, $Pb_aZn_bO_x$, $Rb_aW_bO_x$, $Ru_aSn_bO_x$, $Ru_aW_bO_x$, $Ru_aZn_bO_x$, $Sb_aSn_bO_x$, $Sb_aZn_bO_x$, $Sc_aZr_bO_x$, $Si_aSn_bO_x$, $Si_aTi_bO_x$, $Si_aW_bO_x$, $Si_aZn_bO_x$, $Sn_aTa_bO_x$, $Sn_aTi_bO_x$, $Sn_aW_bO_x$, $Sn_aZn_bO_x$, $Sn_aZr_bO_x$, $Sr_aTi_bO_x$, $Ta_aTi_bO_x$, $Ta_aZn_bO_x$, $Ta_aZr_bO_x$, $Ti_aV_bO_x$, $Ti_aW_bO_x$, $Ti_aZn_bO_x$, $Ti_aZr_bO_x$, $V_aZn_bO_x$, $V_aZr_bO_x$, $W_aZn_bO_x$, $W_aZr_bO_x$, $Y_aZr_bO_x$, $Zn_aZr_bO_x$, $Al_aNi_bO_x$ with frit additive, $Cr_aTi_bO_x$ with frit additive, $Fe_aNi_bO_x$ with frit additive, $Fe_aTi_bO_x$ with frit additive, $Nb_aTi_bO_x$ with frit additive, $Nb_aW_bO_x$ with frit additive, $Ni_aZn_bO_x$ with frit additive, $Ni_aZr_bO_x$ with frit additive, or $Ta_aTi_bO_x$ with frit additive;

and/or

$M^1{}_aM^2{}_bM^3{}_cO_x$ is $Al_aMg_bZn_cO_x$, $Al_aSi_bV_cO_x$, $Ba_aCu_bTi_cO_x$, $Ca_aCe_bZr_cO_x$, $Co_aNi_bTi_cO_x$, $Co_aNi_bZr_cO_x$, $Co_aPb_bSn_cO_x$, $Co_aPb_bZn_cO_x$, $Cr_aSr_bTi_cO_x$, $Cu_aFe_bMn_cO_x$, $Cu_aLa_bSr_cO_x$, $Fe_aNb_bTi_cO_x$, $Fe_aPb_bZn_cO_x$, $Fe_aSr_bTi_cO_x$, $Fe_aTa_bTi_cO_x$, $Fe_aW_bZr_cO_x$, $Ga_aTi_bZn_cO_x$, $La_aMn_bNa_cO_x$, $La_aMn_bSr_cO_x$, $Mn_aSr_bTi_cO_x$, $Mo_aPb_bZn_cO_x$, $Nb_aSr_bTi_cO_x$, $Nb_aSr_bW_cO_x$, $Nb_aTi_bZn_cO_x$, $Ni_aSr_bTi_cO_x$, $Sn_aW_bZn_cO_x$, $Sr_aTi_bV_cO_x$, $Sr_aTi_bZn_cO_x$, or $Ti_aW_bZr_cO_x$.

In certain other preferred embodiments, the metal oxide materials may include those which are in an array of first and second chemo/electro-active materials, wherein the chemo/electro-active materials are selected from the pairings in the group consisting of

(i) the first material is M^1O_x, and the second material is $M^1{}_aM^2{}_bO_x$;

(ii) the first material is M^1O_x, and the second material is $M^1{}_aM^2{}_bM^3{}_cO_x$;

(iii) the first material is $M^1{}_aM^2{}_bO_x$, and the second material is $M^1{}_aM^2{}_bM^3{}_cO_x$;

(iv) the first material is a first M^1O_x, and the second material is a second M^1O_x;

(v) the first material is a first $M^1{}_aM^2{}_bO_x$, and the second material is a second $M^1{}_aM^2{}_bO_x$; and

(vi) the first material is a first $M^1{}_aM^2{}_bM^3{}_cO_x$, and the second material is a second $M^1{}_aM^2{}_bM^3{}_cO_x$;

wherein M^1 is selected from the group consisting of Ce, Co, Cu, Fe, Ga, Nb, Ni, Pr, Ru, Sn, Ti, Tm, W, Yb, Zn, and Zr; M^2 and M^3 are each independently selected from the group consisting of Al, Ba, Bi, Ca, Cd, Ce, Co, Cr, Cu, Fe, Ga, Ge, In, K, La, Mg, Mn, Mo, Na, Nb, Ni, Pb, Pr, Rb, Ru, Sb, Sc, Si, Sn, Sr, Ta, Ti, Tm, V, W, Y, Yb, Zn, and Zr, but M^2 and M^3 are not the same in $M^1{}_aM^2{}_bM^3{}_cO_x$; a, b and c are each independently about 0.0005 to about 1, provided that a+b+c = 1; and and x is a number sufficient so that the oxygen present balances the charges of the other elements in the compound.

The sensor materials may optionally contain one or more additives to promote adhesion or to alter the conductance, resistance or selectivity thereof. Examples of additives to promote adhesion are frits, which are finely ground glass, or finely ground inorganic minerals that are transformed into glass or enamel on heating. Illustrative frits include those designated as F2834, F3876, F2967, KH770, KH710 and KH375, available from DuPont Technologies. These may be used in amounts of up to 30 volume percent of the composition from which the sensor material is made. Examples of additives to alter the conductance, resistance or selectivity include Ag, Au or Pt as well as frits. If desired, the sensor materials may also contain additives, for example, that catalyze the oxidation of a gas of interest or promote the selectivity for a particular analyte gas, or other dopants that convert an n semiconductor to a p semiconductor, or vice versa. These additives may be used in amounts of up to 30 weight percent of the composition from which the sensor material is made. Any frits or other additives used need not be uniformly or homogeneously distributed throughout the sensor material, but may be localized on or near a particular surface thereof as desired.

Any method of depositing the chemo/electro-active material to the substrate is suitable. One technique used for deposition is applying the semiconducting material on an alumina substrate on which electrodes are screen printed. The semiconducting material can be deposited on top of electrodes by hand painting semiconducting materials onto the substrate, nanopipetting materials into wells, thin film deposition, or thick film printing techniques. Most techniques are followed by a final firing to sinter the semiconducting materials.

Techniques for screen-printing substrates with the electrodes and chemo/electro-active materials are